DISCUSSION OF THE CLAIMS

Claims 1-3, 7-8 and 10-13 are active in the present application. Claims 4-6 and 9 are canceled claims. Claims 10-13 are new claims. Support for the new claims is found in the previously presented claims, the original claims and in the examples of the specification.

No new matter is added.

REMARKS

Applicants thank the Office for withdrawing the rejection of the claims set forth in the October 22, 2008 Office Action.

The Office rejected the previously presented claims as obvious over Agarwal (U.S. 6,699,777) and Verhaverbeke (U.S. 7,159,599). The present independent claims describe a semiconductor device that has a film mainly formed of tungsten and a film of silicon. Applicants submit that the presently pending claims are not obvious over the cited art.

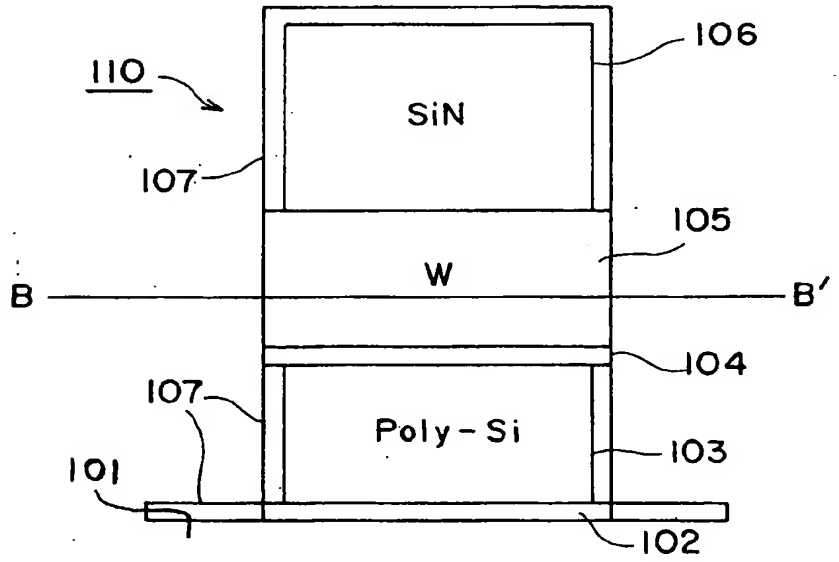
The Office is of the opinion that Figure 5 of the Agarwal reference describes manufacturing a poly-metal stack (100) which functions as a gate electrode. The Office asserts that Agarwal discloses a process that includes forming a gate dielectric layer (106) on a semiconductor substrate (102). A polysilicon layer (108) is formed on the gate dielectric layer (106) and a barrier layer (110) is subsequently formed on the polysilicon layer (108) followed by a tungsten-based metal layer (112). A silicon dioxide layer (114) is formed on a tungsten-based metal layer (112).

In a next step of the Agarwal process the sidewalls of the polysilicon layer (108), the tungsten-based metal layer (112) and the silicon oxide layer (114) are covered with a barrier layer (115). The barrier layer may be made from materials such as oxides and may thus function as an oxide layer.

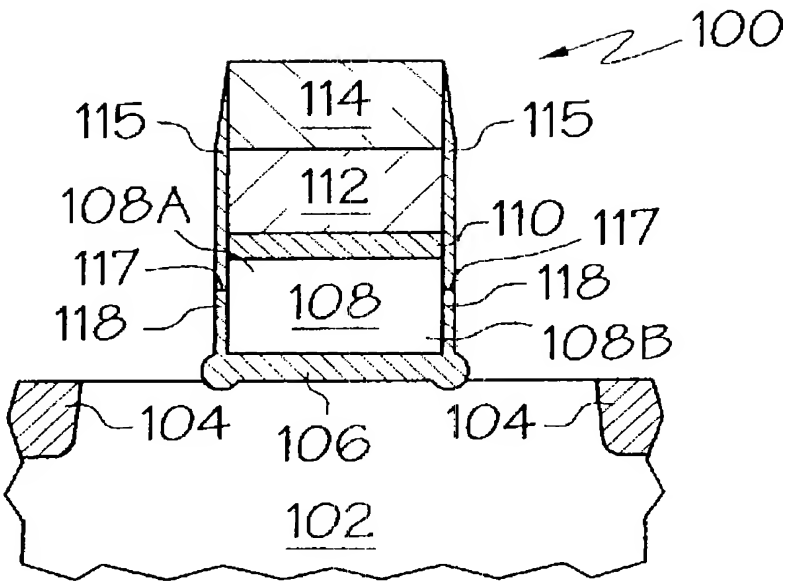
Applicants disclose and claim a different process. The present specification discloses a process for making a gate electrode. The first step of the process disclosed in the present invention includes forming a gate oxide film (102) on a silicon wafer (101). A polysilicon electrode layer (103) is formed on the gate oxide film (102) also. A barrier layer (104) is formed on a polysilicon electrode layer (103) and a tungsten layer (105) is further formed on the barrier film (104). A silicon nitride layer (106) is formed on the tungsten layer (105).

An oxide insulating film (107) is then formed on the side surfaces of the polysilicon electrode layer (103) and the silicon nitride layer (106) by plasma processing. During such plasma processing the side surface of the tungsten layer (105) is not covered with the oxide insulating film (107). This effect is demonstrated in Figures 2A and 2B of the present specification. Figure 2B shows that the tungsten layer "W" (105) does not have a side-covering of the oxide insulating film material (107).

FIG. 2B



In contrast, Agarwal discloses a process in which the side surfaces of the tungsten layer are covered with an oxide barrier film. This structure is readily evident in the figure on the face of the Agarwal patent, reproduced below for convenience.



The tungsten-based material layer of Agarwal is identified as reference no. 112. The oxide barrier film is identified as reference no. 115. It is clear that the tungsten-based metal layer has side surfaces covered with an oxide barrier film.

Present Claim 1 recites a step of forming an oxide film in a manner "so as not to form the oxide film on an exposed surface of the second layer" (the second layer is a film mainly formed of tungsten).

Applicants submit that the present claims and the disclosure of Agarwal are mutually exclusive and thus the presently claimed invention in not obvious in view of the cited art.

The Office is of the opinion that the Verhaverbeke reference may disclose a process that includes plasma processing carried out in a manner to avoid oxidation of a tungsten layer. Even if the Office's assertion were correct (Applicants make no such admission), the present claims are nonetheless patentable over the combination of Agarwal and Verhaverbeke for the reason that the Verhaverbeke process utilizes different gas stream than that of the present claims.

The present claims recite a step of forming an oxide layer using a process gas that contains an inert gas, oxygen gas and hydrogen gas. In contrast, the Verhaverbeke process

includes water. In fact, Verhaverbeke discloses that the use of certain mixtures of hydrogen gas and oxygen gas forms an "ambient" which permits the utilization of a gas stream having optimizable hydrogen/water and/or oxygen/water concentrations (see column 9, line 52 - column 40, line 3 of Verhaverbeke).

Steam, e.g., vaporous water, will not selectively oxidize a silicon layer in the presence of tungsten (e.g., oxidize silicon without also oxidizing tungsten). Instead, water will oxidize both silicon and tungsten. Applicants draw the Office's attention to new dependent Claims 12 and 13 wherein the step of forming an oxide film is carried out by a process gas that consists of an inert gas, oxygen gas and hydrogen gas.

Even if the Office's assertion were correct that it is possible to modify the Agarwal process in a manner such that certain tungsten film surfaces are not covered with an oxide film, the combination of Agarwal and Verhaverbeke fails to disclose the presently claimed invention because each of the Agarwal and Verhaverbeke processes are excluded from the present claims.

For the reasons discussed above in detail, Applicants request withdrawal of the rejection and the allowance of all now-pending claims.

Respectfully submitted,

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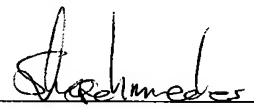

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